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14. ABSTRACT This report results from a contract tasking Epichem Ltd as follows: The contractor, in close collaboration with the University of Liverpool, UK, Dr. Anthony C. Jones, will investigate the fundamental chemistry required to synthesize mono-amine adducts of aluminum trichloride and study the mechanism of Aluminum liberation from this synthesized adduct during Hydride Vapor Phase Epitaxy (HVPE) deposition. The goal of this research is to optimize and characterize aluminum trichloride for use in Aluminum Nitride production using HVPE. In addition to the research, four Aluminum Trichloride formulations will be synthesized and sent to AFRL/ISMC					
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Summary

This report details work carried out under contract no FA8655-02-M4090 from EOARD at Epichem Ltd.

Four samples of aluminium chloride adducts have been synthesised and dispatched for testing in HVTE of AlN layer growth at Hanscom Air Force Base, MA, USA.

The tertiarybutyl amine adduct has a higher vapour pressure and is more straightforward to synthesise, by a direct reaction between aluminium chloride and tertiarybutyl amine. The equivalent reaction between aluminium chloride and ammonia first forms the 6:1 adduct which can then be converted into the 1:1 adduct by heating.

Elemental analysis and nmr spectroscopy (250MHz Bruker).confirm that the 1:1 adducts were made.

During the course of this work the tertiarybutyl amine adduct become the precursor of choice and this work continues at Epichem Inc (MA, USA) funded under the Broad Agency Announcement BAA-AFRL/SNH03-01 contract no F19628-03-0060.(program manager Dr. Dave Weyburne, AFRL).

Analytical details

The details of the four samples can be found in table 1 below

Material	Amount sent	Date	Batch #	Prep #	C,H,N
t-BuNH2 adduct	51g	16/01/2003	1192790103	WM11	see below
NH3 adduct	25.g	28/04/2003	1196220403	WM18	see below
t-BuNH2 adduct	67g	11/09/2003	1199930903	WM20	-
t-BuNH2 adduct	48g	10/11/2003	1200931003	AP2-D	-

Table 1 : Sample details

In order to ensure that the correct product had been synthesised (ie the 1:1 adduct) the material was analysed for carbon, hydrogen, nitrogen, chlorine and aluminium content, and the details are summarised in table 2(a) and (b) below.

Table 2 : Analysis of the adducts for carbon, hydrogen, nitrogen, chlorine and aluminium

	Al	Cl	N	H	C
Predicted	14.31	50.77	6.69	5.3	22.93
Actual 1	13.20	51.38	6.44	5.33	22.54
Actual 2	13.13	50.89	6.59	5.31	22.77
Average	13.17	51.13	6.52	5.32	22.66

(a) t-BuNH2 Adduct (prep reference WM11)

AQ F04-09-1008

DTIC Copy

(b) NH3 Adduct (prep reference WM18)

	Al	Cl	C	N	H	Total%	<u>Discla</u> <u>imers</u>
Predicted	17.9	70.7	0	9.3	2.1	100	There were no patent s filed based upon
Actual 1	17.1	68.96	1.12	8.82	1.98	97.98	
Actual 2	16.88	69.1	0.79	8.84	1.99	97.6	
Actual 3			0.82	8.9	1.97		
Actual							
Average	16.99	69.03	0.91	8.853333	1.98	97.76333	

this research.

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